■ Intel's 440LX Is First AGP Chip Set

The much-anticipated 440LX chip set is now available, bringing AGP to the PC platform for the first time. But since the 440LX works only with Pentium II, Pentium systems won't have access to AGP until other vendors deploy Pentium/AGP chip sets. (Intel has no plans to develop such a product.)

An upgrade to the 440FX (see MPR 5/6/96, p.15), the 440LX uses a "quad-port" architecture, adding the 533-Mbyte/s AGP (see MPR 6/17/96, p. 11) to the standard CPU, memory, and PCI interfaces found on earlier chip sets. The memory controller on the 440LX supports a 66-MHz SDRAM array with optional parity and ECC protection. Other features improved over the 440FX include an Ultra DMA-33 IDE hard-disk controller and full compliance with the ACPI power-management standard.

The 440LX chip set consists of the 82443LX PCI/AGP controller (PAC) in a 492-ball BGA and the fourth-generation 82371AB PCI-ISA bridge and IDE accelerator (PIIX4) in a 324-ball BGA. Pricing in 10,000-unit quantities is $64 for the set.

The new chip set represents a significant improvement over the 440FX, which supported only EDO DRAM—at half the throughput of SDRAM—and provided relatively low IDE hard-disk performance. The most significant advance is the inclusion of AGP, of course, but preliminary testing suggests that first-generation AGP graphics chips and software offer only incremental improvements over existing PCI-based 3D solutions. The full benefits of AGP will come next year, with better software support in Windows 98 and Windows NT 5.0 and applications better prepared to take advantage of AGP's high sustained throughput.   —*P.N.G.*

■ Intel Snarfs Chips and Technologies

Just as National announced its acquisition of Cyrix (see MPR 8/25/97, p. 1), Intel said it would purchase Chips and Technologies for roughly $440 million in cash. The motives for the transaction are less clear than in the National deal: C&T is best known for its graphics technology, and Intel has already launched its own program to create a 3D graphics accelerator, called the 750. Indeed, Intel had already licensed some of C&T's technology for its own graphics chips.

C&T, however, has been most successful in building graphics chips for notebook computers; Intel's graphics project is aimed at high-end desktop PCs. Intel's stated intent in entering the graphics business is to spur more rapid advancement of the PC platform, thus selling more microprocessors. While the desktop 3D market is, in fact, moving faster than Intel can push it, the CPU vendor has become concerned that progress in notebook graphics is lagging. Although the notebook market represents less than a quarter of PC sales today, that portion is growing, and Intel would like to see more rapid growth.

Intel will also find C&T's sales force valuable once the 750 is available. While Intel's sales force contacts every major PC maker, it does not have the same access to graphics-card vendors that might be interested in Intel's 3D chip. C&T should be able to help in this area. In combination, the two companies can offer a broad range of graphics chips to card and system makers, posing an increasing threat to other graphics-chip vendors. S3, for one, is rumored to be considering filing an antitrust suit to block the deal.

The opportunity to expand its graphics presence could have convinced Intel to make the deal, but the company may have an ulterior motive. With both National and AMD gearing up to produce PC-on-a-chip products, Intel may have to enter this market in the future if it becomes large. Intel already has CPU and system-logic expertise; with C&T on board, the company now has both desktop and mobile graphics capabilities. To fully match up with its competitors, however, Intel will need additional expertise in peripheral logic and multimedia. With more than $7 billion in cash on hand, Intel can acquire such expertise with little trouble.

In many ways, the C&T acquisition is ironic. Former Intel executive Gordon Campbell, regarded as a renegade in Intel circles, founded C&T. After pioneering the system-logic chip-set business, the startup developed a 386-compatible CPU, but the processor was crushed by Intel. Intel later drove C&T (and most other vendors) out of the system-logic business as well. Intel's entry into the graphics market could have caused C&T to change plans again, but this time the smaller company, with founder Campbell long gone, instead became an attractive acquisition.   —*L.G.*

■ Diba Enters Sun's Orbit

The information-appliance designers at Diba (see MPR 6/17/96, p. 16) are now part of Sun. The formerly independent company was snapped up by Sun Microelectronics (SME) for an undisclosed sum; all Diba employees become part of SME's new Consumer Technology Group. The acquisition is intended to fuel Sun's efforts to make Java the *lingua franca* of future computing platforms by reaching into the home market.

The move is widely viewed as a reaction to Microsoft's recent acquisition of WebTV and Oracle/NCI's purchase of Navio, although Diba founders point out the negotiations with Sun started before WebTV's brief courtship with Microsoft began. Navio, WebTV, and now Sun (as well as other companies) are all attempting an end run around conventional PCs with "information appliances"—low-cost systems with limited feature sets based on inexpensive microprocessors. A reliance on Java is about the only thing these future competitors have in common. So far, none has delivered commercial products, although Diba has licensed its technology to Samsung (for televisions) and LodgeNet (for hotel

cable systems). Diba's first licensee, Zenith, has backed out of its agreement.

Although neither Diba nor Sun would announce any product plans or give a roadmap for development, both companies suggested that future versions of Diba's software would be tailored to Java chips (see MPR 10/28/96, p. 28). Diba built its software on 68K processors and now supports PowerPC, Mitsubishi's M32R/D, and NEC's V830; SME says it will continue to support these processors under existing agreements but will "encourage" customers to move to either MicroSparc or Java chips. We expect Diba's support for non-Sun processors to dry up quickly.

According to Chet Silvestri, president of Sun Micro-electronics, Sun's ultimate goal in acquiring Diba is not to sell retail information appliances but to promote the "thin client, fat server paradigm, using Java as the glue." Silvestri would like to see the Diba technology succeed, but the over-riding goal is for Java to become dominant.   —*J.T.*

■ Pentium Pro Gains 1M Cache

At the same time that it detailed its plans for Pentium II chips for servers (see MPR 8/25/97, p. 10), Intel quietly rolled out the final extension to its Pentium Pro line, a 200-MHz version of the chip with a 1M level-two cache. Previous versions of PPro had been limited to 256K or 512K caches. The change brings PPro-based servers more in line with RISC-based servers, which often sport 1M or more of L2 cache per processor, and boosts the transaction-processing performance of PPro servers by 5–20% over that of 200-MHz systems with 512K caches, according to Intel. The new processor is now shipping in volume, and vendors such as Compaq, Hewlett-Packard, Sequent, and Unisys plan to introduce servers using the 1M processor shortly.

The current Pentium Pro has a single MCM package that holds the processor chip along with a custom L2 cache chip that includes the memory and tags for 512K of cache (see MPR 2/16/95, p. 9). Because the 512K cache chip measures 242 mm^2 in Intel's 0.35-micron process, a single-chip 1M cache would be much too large to build in that process, and Intel's 0.25-micron process is not quite ready yet. Thus, the new Pentium Pro uses a three-chip MCM that holds the CPU chip along with two 512K cache chips.

The new package is pin-compatible with the two-chip module and is physically the same size. Instead of a dual-cavity design, however, the new module has a single large cavity that holds the three die. As in the two-chip package, the die are attached to the substrate using simple wire bonding. The cost of the substrate is increased due to the greater number of signals that must be routed. At 47 W, the processor dissipates 24% more power than the 512K version.

Intel should have no problem covering the higher manufacturing cost of the three-chip device, since the list price for the 1M PPro is $2,675. This price breaks the previous Intel record of $1,981 set three months ago with the introduction of the Pentium II-300. Since the 512K PPro

sells for $1,035, the new chip places a value of $1,640 on 512K of 200-MHz SRAM, more than ten times the street value of discrete SRAM. In a $100,000 server, however, a 10% performance boost could allow the vendor to charge an extra $10,000, more than enough to cover the extra cost for four 1M PPro processors.

Since the 1M cache requires no new silicon, the product could have been introduced many months ago, but the new packaging technology delayed the schedule. Even today, Pentium II is limited to two-processor systems, so Pentium Pro continues to be the choice for four-way servers. The 1M cache extends the performance of these servers and will be popular for them until the Slot 2 versions of Pentium II appear in mid-1998.   —*L.G.*

■ Samsung Puts Alpha Into Production

Providing a third source for the 21164, Samsung Semiconductor announced it will begin in September volume shipments of the Alpha chip at clock speeds ranging from 400 to 533 MHz. A 600-MHz version, matching Digital's top clock speed, is expected to reach volume production by November. The company is also producing the 21164PC at speeds of 400, 466, and 533 MHz. Pricing for the 21164, in quantities of 1,000, starts at $275 for the 400-MHz version and climbs to $500 for the 500-MHz chip and $850 for the 533-MHz 21164. Pricing for the 21164PC ranges from $266 to $446.

Samsung's pricing for the 21164PC is about 10% below Digital's, but its 21164 prices are very aggressive, more than 60% less than Digital's published prices. Digital has not cut its published prices since last December and would probably match Samsung's prices in a competitive situation. Digital, however, is probably happy to let Samsung satisfy the minimal third-party demand for Alpha chips.   —*L.G.*

■ Toshiba Samples R4300 Chips

Toshiba has quietly rolled out the first samples of its R4300 microprocessor, providing a second source for the NEC device (see MPR 5/8/95, p. 1). Toshiba's first chips are running at 100 MHz; 133-MHz samples are expected to follow in September. The company expects volume production of both parts to start in 4Q97. Pricing has not been announced.

The R4300 has been a big success, not only in the well-publicized Nintendo 64 but also in several other areas, including some QMS laser printers and Cisco network routers. In addition, NEC has showed Windows CE running on its powerful processor (see MPR 6/23/97, p. 5).

Toshiba became authorized to build R4300 chips at the insistence of Nintendo, which demanded an alternate source for its processor. As part of the agreement, NEC was granted one year of exclusivity, which is why Toshiba has not sampled the R4300 until now. Toshiba, long a supplier and second source for high-end desktop MIPS processors, has been relatively quiet in the embedded arena the past few years. Its recent introduction of the 1904AF chip (see MPR 8/4/97, p. 9) indicates it is ready to make some noise.   —*J.T.* Ⓜ